

BIOENG-399

Immunoengineering

Tang Li

Cursus	Sem.	Type
Biotechnology minor	E	Opt.
Computational and Quantitative Biology		Opt.
Life Sciences Engineering	BA6, MA2, MA4	Opt.
Materials Science and Engineering	MA2, MA4	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	Written
Workload	120h
Weeks	14
Hours	4 weekly
Lecture	2 weekly
Exercises	2 weekly
Number of positions	

Summary

Immunoengineering is an emerging field where engineering principles are grounded in immunology. This course provides students a broad overview of how engineering approaches can be utilized to study immunology, model immune systems, modulate immune response, and develop novel immunotherapies.

Content**Part 1. Understanding immunology with engineering tools**

Introduction of the course and expectation
 Overview of the fundamentals of immunology
 Definition and scope of immunoengineering
 Engineering tools and new technologies to understand immunology

Part 2. Engineering novel immunotherapies for diseases

Cancer and cancer immunotherapies
 Concept and overview of drug delivery
 Materials engineering in the advancement of immunotherapies
 Immune cell engineering and genetic engineering
 Metabolic engineering and immune modulation
 Overview of adaptive immunity and vaccines
 Design of immunogenic vaccines
 Other vaccines
 Protein engineering in vaccine design

Part 3. Applications and practical issues

Considerations on immune drug discovery and development

Keywords

immunology, immunoengineering, vaccines, infectious diseases, autoimmunity, cancer, materials engineering, drug delivery, protein engineering, drug discovery and development

Learning Prerequisites**Required courses**

This class requires a basic knowledge in biology, physics, chemistry, and materials science. BIO-310 Immunology or an equivalent is required

Learning Outcomes

By the end of the course, the student must be able to:

- Describe the concept of immunoengineering
- Make examples of how engineering approaches has led to advancements in immunotherapy
- Take into consideration how to apply engineering principles to immunology research and applications
- Specify 1. Understand how to apply engineering principles to immunology research and applications
- 2. Show examples of how engineering approaches has led to advancements in immunotherapy and diagnosis
- 3. Describe the discovery or development of new immunotherapies from recent scientific literatures

Transversal skills

- Write a scientific or technical report.
- Communicate effectively, being understood, including across different languages and cultures.
- Write a scientific or technical report.
- Communicate effectively with professionals from other disciplines.

Assessment methods

Scientific ssay writing: 30%

Final written exam: 70%

Supervision

Office hours Yes

Assistants Yes

Forum Yes

Others *Library resources*

How the immune system works: Lauren Sompayrac. all versions

Kuby Immunology: Owen, Pung, Stranford. all versions

Cellular and Molecular Immunology: Abbas & Lichtman. all versions

Janeway's immunobiology: Kenneth Murphy ; Charles A. Janeway ; Allan Mowat . all versions

Slides/Notes will be provided on Moodle webpage

Resources

Bibliography

Library resources (good to read, but not required)

How the immune system works: Lauren Sompayrac. all versions

Kuby Immunology: Owen, Pung, Stranford. all versions

Cellular and Molecular Immunology: Abbas & Lichtman. all versions

Janeway's immunobiology: Kenneth Murphy ; Charles A. Janeway ; Allan Mowat . all versions

Ressources en bibliothèque

- [How the immune system works / Sompayrac](#)
- [Kuby Immunology / Pung](#)
- [Cellular and Molecular Immunology / Abbas](#)
- [Janeway's immunobiology / Murphy](#)

Notes/Handbook

Slides/Notes will be provided on Moodle webpage

Moodle Link

- <https://go.epfl.ch/BIOENG-399>